MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

BMF1014 – MATHEMATICS FOR FINANCE

(All Sections/Groups)

17 FEBRUARY 2023
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **SIX (6)** printed pages with 4 questions only, excluding the cover page.

2. Attempt **ALL FOUR (4)** questions.

3. Write all your answers in the Answer Booklet provided. All necessary workings **MUST** be shown.

4. The mathematical formula sheet is attached at the end of this question paper.

QUESTION 1 [25 marks]

(a) Find the market equilibrium point for the following demand and supply functions.

$$\begin{aligned} \text{Demand:} \quad & q = 56 - 2p \\ \text{Supply:} \quad & q = 3p - 34 \end{aligned}$$

(5 marks)

(b) Calculate the interest rate if the simple interest earned is RM 140 for a 9-month investment of RM 1030.

(3 marks)

(c) $500 is deposited at the end of every month into a bank account which pays annual interest rate of 8.4% compounded monthly. Find the value of the deposit after 5 years.

(5 marks)

(d) A finance student wish to accumulate amount RM 200,000 in 8 years. Calculate the amount that the student should deposit in each quarter if the money invested earns annual interest of 15% compounded quarterly.

(5 marks)

(e) A young couple decided to make a $30,000 down payment on a $150,000 home. They plan to secure a mortgage with interest rate of 7.2% per year compounded monthly on the unpaid balance. If the loan is amortized over 35 years,

(i) how much should the couple pay at end of each month? (5 marks)

(ii) how much interest will be paid over the course of the loan? (2 marks)

QUESTION 2 [25 marks]

(a) If $\mathbf{A} = \begin{bmatrix} 5 & 2 \\ -4 & 0 \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} 8 & 7 \\ -6 & 1 \end{bmatrix}$ and $\mathbf{C} = \begin{bmatrix} -2 & 6 \\ -3 & 5 \end{bmatrix}$, show that $(\mathbf{A} + \mathbf{B}) + \mathbf{C} = \mathbf{A} + (\mathbf{B} + \mathbf{C})$.

(8 marks)

Continued...

(b) Consider the following system of equations

$$x-3y+4z=16$$
$$10x+8y-8z=20$$
$$3x+2z=8$$

(i) Write the system of equation above in a form $\mathbf{AX} = \mathbf{B}$. (3 marks)

(ii) Find the determinant, minor and the inverse of matrix **A**. (11 marks)

(iii) Find value of x, y and z. (3 marks)

QUESTION 3 [25 marks]

(a) The daily total cost for producing a scientific calculator is given by

$$C(x)=0.4x^4-0.7x^3+12x^2+400$$

Ringgit Malaysia, where x stands for the number of scientific calculators produced.

(i) Find the marginal cost function. (3 marks)

(ii) Find the average cost function, $\overline{C}(x)$. (2 marks)

(iii) Compute $\overline{C}'(300)$. (4 marks)

(b) Find the derivatives of the following functions using the appropriate techniques.

(i) $f(x)=\left(2x^3+6\right)\left(2\sqrt{x}-\frac{1}{3}\right)$ (6 marks)

(ii) $y=2x+\sqrt[3]{4x+5}$ (4 marks)

(c) Evaluate the following integral:

$$\int_2^5\left(e^x+2\sqrt{x}+4x^3-12\right)dx.$$

(6 marks)

Continued...

QUESTION 4 [25 marks]

A local family firm produces type-A and type-B gemstones, which sells at different rates. The revenue function for the firm is given by:

$$R(x, y) = 122x + 420y$$

The cost function is given by:

$$C(x, y) = 2x^2 - 3xy + 5y^2 + 100$$

where x and y and are the quantities of the type-A and type-B gemstones, respectively, that are produced and sold.

(a) Find the profit function and its critical point. (16 marks)

(b) Determine the profit-maximizing output levels for each product and the firm's maximum profit.

(9 marks)

End of Questions.

APPENDIX

Summary of Principal Formulas and Terms

1. Quadratic Formula

The solution of the equation: $ax^2 + bx + c = 0$ where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

(ii) Accumulated amount, $A = P(1 + rt)$

3. Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

4. Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

5. Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

(S = future value of ordinary annuity of n payments of R periodic payment)

6. Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

(P = present value of ordinary annuity of n payments of R periodic payment)

7. Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$

(R = periodic payment on a loan of P to be amortized over n periods)

8. Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$

(R = periodic payment required to accumulate S over n periods)

9. Basic Rules of Differentiation

(a) Derivative of a constant: If $f(x)$ is a constant, then $f'(x) = 0$

(b) Power rule : If $f(x)$ is x^n, then $f'(x) = nx^{n-1}$

(c) Constant multiple rule: $\frac{d}{dx}\left[cf(x)\right] = cf'(x)$ (c is a constant)

(d) Sum rule: $\frac{d}{dx}\left[f(x) \pm g(x)\right] = f'(x) \pm g'(x)$

(e) Product rule: If $f(x) = u(x) \cdot v(x)$, then $f'(x) = u(x)v'(x) + v(x)u'(x)$

(f) Quotient rule: $f'(x) = \frac{d}{dx}\left[\frac{u(x)}{v(x)}\right] = \frac{v(x)u'(x) - u(x)v'(x)}{\left[v(x)\right]^2}$

(g) Chain rule: $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

(h) General power rule: $\frac{d}{dx}\left[f(x)\right]^n = n\left[f(x)\right]^{n-1} f'(x)$

(i) Exponential function: $\frac{d}{dx}\left(e^x\right) = e^x$

$$\frac{d}{dx}\left(e^{f(x)}\right) = e^{f(x)}\left[f'(x)\right]$$

(j) Logarithmic function: $\frac{d}{dx}\left(\ln x\right) = \left(\frac{1}{x}\right)$

$$\frac{d}{dx}\left(\ln f(x)\right) = \frac{f'(x)}{f(x)}$$

10. Basic Rules of Integration

(a) Indefinite integral of a constant: $\int k\ dx = kx + C$

(b) Power rule: $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

(c) Constant multiple rule: $\int kf(x)\ dx = k\int f(x)\ dx$ where k is a constant

(d) Sum rule: $\int\left[f(x) \pm g(x)\right] dx = \int f(x)dx + \int g(x)dx$

(e) Exponential function: $\int e^x dx = e^x + C$

(f) Logarithmic function: $\int\left(\frac{1}{x}\right) dx = \ln x + C$

11. Determining Relative Extremas

$$D(x,y) = f_{xx}f_{yy} - \left(f_{xy}\right)^2$$

If $D > 0$ and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If $D > 0$ and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If $D < 0$, (x, y) is neither maximum nor minimum.
If $D = 0$, the test is inconclusive.

End.